Prepared for:
Unocal Corporation
California

Remedial Design Workplan

ENSR Corporation
February 10, 2006
06940-407

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ENSR Corporation

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Remedial Action Plan

Union Oil Company of California (Unocal) has retained ENSR Corporation (ENSR) to prepare this Remedial Design Workplan (RDW) for the former Unocal bulk plant #762248 located at 359 Main Street in Fortuna, California (the "Site") as depicted in **Figure 1** (Site Location Map) and **Figure 2** (Site Plan).

1.0 Objective

The purpose of this Remedial Design Workplan (RDW) is to detail the localized/focused excavations of suspected source areas that will be performed on the former Unocal bulk plant. These excavations are to remove residual light nonaqueous phase liquid (LNAPL) source areas. Removal of this impacted source area material is expected to reduce the impact of residual LNAPL sources on groundwater and allow for the natural attenuation of the petroleum hydrocarbons. The selected remedial option to excavate identified areas of impacted soils was based on the *Corrective Action Plan* (CAP) (ENSR, Sept. 2005) approved by the North Coast Water Board (NCWB) in December 2005. The extent of the excavation will be limited to the Site, and defined by the property boundaries, delineated extent of petroleum hydrocarbon soil concentrations greater then 1,000 mg/kg, and a depth not to exceed 18 feet below ground surface (bgs). Site features or implementation requirements, or other factors that impact the ability to perform the excavation safely may also limit the extent of the removal action.

1.1 Site Description and Location

The Site is currently vacant and consists of an approximately 1-acre lot located at 359 Main Street in an industrial section of Fortuna, California. The Site is bordered to the north by Main Street, to the south by the Northwest Pacific Railroad tracks, to the east by vacant land, and to the west by a former Chevron bulk plant. The former Chevron bulk plant is on file with the NCWB as a closed case. The Site is situated in the northern portion of the Eel River Valley (refer to Site Location Map, **Figure 1**). The pertinent site features are depicted on the Site Plan, **Figure 1**. According to previous reports, the Site was utilized as a bulk storage facility from approximately 1924 through 1984. Petroleum impacts were detected when subsequent site owners were redeveloping the site in 1988. Previous investigations and reported releases have identified that gasoline, diesel, and aromatic constituents of those fuels have impacted the soil and groundwater at the Site. Since 1988, multiple subsurface investigations have been performed. In addition and as a result of data obtained from the subsurface investigations, corrective action plans, remedial action plans, and feasibility studies have been developed.

1.2 Background Information

The following sections summarize information presented in the CAP and provide information on the site history and on previous investigations, studies, and bench-scale tests performed. The site conceptual model inclusive of the known contaminant distribution is also presented. These excerpted sections are included in the RDW to make available a more complete understanding of the Site.

1.2.1 Site History

While under Unocal's ownership, five aboveground storage tanks (ASTs) were located on site. Based on information from previous reports, four of the ASTs had capacities of 19,450 gallons each, and one had a capacity of 20,270 gallons. Kerosene, diesel fuel, and regular and unleaded gasoline were stored in these tanks. Reportedly, petroleum products were distributed from the AST area through an underground product piping system to two truck loading racks and a truck loading area associated with the on-site warehouse. Bulk loads of fuel were delivered to the site by rail, with a dedicated rail spur located in the southwestern portion of the Site.

Gasoline and diesel-related constituents have impacted the soil and groundwater at the Site as a result of two documented releases in 1974 and 1978 and from suspected miscellaneous releases due to the use of the property as a bulk storage facility. The volume of gasoline released in 1974 was estimated at 1,000 gallons and was caused by an overfill event. In addition, another release of petroleum hydrocarbons was reported and documented in 1978. On January 17, 2003, personnel at the NCWB provided SCS of Dublin, California (Unocal's environmental consultant at the time) with information regarding two incidents relating to the Site that reportedly took place in 1978. Apparently, the Fortuna Department of Public Works determined that two explosions that occurred at a bowling alley and the North Main Street lift stations on February 11 and 19, 1978 were related to gasoline vapors emanating from the Unocal site along sewer lines beneath Main Street. Following investigations on the Unocal property, a leak was discovered and repaired in a gasoline product line approximately 20 to 30 feet east of the retaining wall surrounding the former AST area. The volume of gasoline released from this leaking line is unknown.

In the late 1980s, the ASTs and associated appurtenances were removed from the site. During the investigative phase of the redevelopment of the Site, the discovery of hydrocarbon impacts to soil beneath the site was reported to regulatory agencies. Subsequently, Unocal and the site owner at the time received a letter response from the NCWB, dated August 15, 1990. This letter notified the two respective parties that a hydrogeological assessment was required at the Site to evaluate the possible impacts to groundwater from an apparent release of hydrocarbons to soil previously discovered on site during site construction activities. As a result of this letter and subsequent on-site investigation activities, approximately 2,700 tons of impacted soil were removed and disposed off site between 1997 and 2000.

1.2.2 Previous Investigations

The following summarizes subsurface site investigations performed in response to the request from the NCWB.

- March 1991 - Applied Geosystems, Inc. (Applied Geosystems), of Rancho Cordova, California, installed six soil borings (B-1 through B-6) which were subsequently completed as groundwater monitoring wells (MW-1 through MW-6). Applied Geosystems reported that groundwater beneath the Site was apparently impacted with dissolved gasoline hydrocarbons with two apparent on-site source areas: the area surrounding the truck loading rack and the AST complex.

- June and July 1992 - RESNA Industries (RESNA), of Rancho Cordova, California, provided oversight for the installation of 21 soil borings (B-7 through B-15 and B-17 through B-22), four of which were completed as monitoring wells. Borings B-7, B-8, B-9 and B-20 were completed as groundwater monitoring wells MW-7 through MW-10, respectively. In addition, eight borings (HP-2 through HP-9) were advanced at off-site locations to the water table using Hydropunch technology. Soil and groundwater samples were collected from these borings. RESNA reported that the highest concentrations of gasoline constituents appeared to be located downgradient of the abandoned product piping lines and the highest concentrations of diesel constituents appeared to be located downgradient of the product lines and AST area.

- August 1995 - Pacific Environmental Group, Inc. (PEG) oversaw the advancement of three soil borings (G-1, G-2 and G-3) via direct-push methodologies in the northeastern portion of the former Chevron bulk plant, abutting the Site to the west. The borings were advanced to a depth of 20 feet bgs with soil samples collected from each boring at depths of 7 and 16 feet bgs. Groundwater was encountered in the borings at approximately 18 feet bgs. The PEG report (PEG, October 1995) for the soil boring investigation indicated the presence of monitoring wells located on the Chevron property. The figures showing the reported monitoring well locations labeled the wells M-1 through M-4. These monitoring wells are located in the western portion of the property. Two piezometer wells, designated PZ-1 and PZ-2 were identified in the center of the subject Site; however, no additional information regarding these piezometers was identified.

- April 1996 - PEG conducted an assessment of soil and groundwater quality on the Friedenbach property, which abuts the former Unocal property to the east. Four soil borings (GP-1 through GP-4) were advanced via direct-push methodologies. The borings were installed to a depth of 10 feet bgs with soil collected from each boring at depths of five and 10 feet bgs. Groundwater was encountered in the borings between six and nine feet bgs.

- August 1998 - To further delineate residual petroleum impacts at the Site, a soil boring survey was conducted by PEG. The survey consisted of 24 soil borings (HA-1 through HA-24) advanced at the site via a combination of handheld drilling, hand-augering and/or a hollow stem auger drill rig, to depths ranging from 3 to 26 feet bgs.

- November 2002 - SCS oversaw the advancement of 11 Geoprobe soil borings (SS-1 through SS-11) in the northwestern portion of the Site for the purpose of investigating the source of separate phase hydrocarbons observed in a well upgradient of the former AST area. Borings were advanced to a depth of 27 feet bgs. Groundwater was generally encountered in the borings at depths greater than 20 feet bgs. A total of eight groundwater samples were collected from select borings that reached that depth and contained sufficient water for sampling (SS-1 through SS-4, SS-6, and SS-9 through SS-11).

- May 2003 - SCS oversaw the advancement of 13 borings (SS-12 through SS-24) and the installation of three monitoring wells (MW-13 through MW-15). The 13 soil borings (SS-12 through SS-24) were advanced using Geoprobe direct push methodologies.

- December 2004 - ENSR conducted additional field investigations. The investigation consisted of advancing 14 soil borings on the Site, with seven borings completed as monitoring wells.

1.2.3 Previous Remedial Testing and Modeling

Previous remedial testing and modeling are summarized below.

- November 1992 - RESNA collected soil samples from impacted areas as part of a biotreatability investigation, and were analyzed for baseline physiochemistry parameters, microbial enumeration and composition, preliminary biodegradation screening, effects of pH, temperature and hydrogen peroxide, effects of nutrient additives, synergistic/antagonistic effects, and specific-degrader identification and characterization.

- Groundwater modeling was also performed using finite difference grid software and data from slug tests. Results indicated that the maximum estimated extraction rate from a single well was 0.3 gallons per minute (gpm), from two wells was 0.2 gpm per well, and from an extraction trench was 0.32 gpm. Resultant capture zones predicted by the model were insignificant. Based on the results of the biotreatability investigation and groundwater modeling, RESNA found that biostimulation methods would be efficient at cleaning the residual petroleum impacts at the Site. However, a significant increase in permeability of the soils would be required for successful in-situ treatment at the site.

- July 1993 - Unocal Corporate Environmental Remediation and Technology (C.E.R.T.) and RESNA performed a field demonstration of air sparging, hydraulic fracturing, and vapor extraction technologies.

- July 1993 - Three horizontal wells were installed at the Site, one air sparging, and two for vapor extraction. S soil gas survey and soil vapor extraction/air sparge (SVE/AS) test was performed. Results of the air sparge test indicated that the sparge well had a radius of influence of approximately nine to 20 feet at the west end and midpoint of the fractured well; however, the flow was not evenly distributed at the western end of the well. Significant mass transport of hydrocarbons from the

groundwater to the soil vapor was observed during the test. As a result of the short duration of the test, biodegradation of the hydrocarbons was not observed. RESNA concluded that hydraulic fracturing increased permeability near the well, however, the fracture density was low. Furthermore, RESNA concluded that even though fracturing increased the rate of extraction, the volume (mass) of VOC removal was insufficient to allow for SVE to be an economically viable remedial technology at the site.

- October 1994 to February 1995 - Pacific Environmental Group, Inc. (PEG) of San Jose, California conducted a biovent test at the Site in order to 1) evaluate the feasibility of bioventing at the site and 2) estimate the biodegradation rates in the vadose zone beneath the site. Results of the biovent test indicated that hydrocarbon degradation did occur in the vadose zone during the test period. Furthermore, dissolved hydrocarbons were being effectively stripped from the groundwater in the vicinity of the sparge well and dissolved oxygen levels increased in this area.

  The biovent test to determine oxygen utilization rates was conducted between November 9 and 19, 1994. Results indicated that biodegradation of hydrocarbons was likely occurring at the Site, compared to background levels, with the highest degree of oxygen utilization occurring in the area of highest hydrocarbon concentrations.

- 2005 - ENSR conducted a bench-scale treatability test for in-situ chemical oxidation using soil and groundwater samples collected from the December 2004 soil investigation activities. The results from the treatability test indicated that both Fenton's reagent and persulfate could destroy petroleum hydrocarbons in the Site's soil and groundwater. The Fenton's reagent and activated persulfate affected several water quality parameters (chromium, iron, nickel, sulfate, and pH) while the un-activated persulfate affected a few parameters (sulfate and pH). The practicality of field implementation would require further investigation.

- March 2005 - A multi-phase extraction (MPE) pilot test was conducted. An existing shallow well (MW-4, screened 5-25 feet bgs) and a deep well (MW-1, screened 20-39 feet bgs) were utilized as extraction wells to perform the limited pilot test. Three activities were completed during the pilot test and consisted of: (1) a zero vacuum drawdown test (pump test), (2) a step test, and (3) a constant rate test. The results indicate that without costly soil fracturing measures MPE does not appear to be a feasible means to remove the residual contaminants present in the on-site soils. This conclusion was based on the limited amount of air flow that can be obtained from the native soils on site.

Based on the results of the bench and pilot testing and other remedial technology evaluations as presented in the CAP, the NCWB approved the recommended remedial action of limited excavation with a phased approach to natural attenuation.

1.3 Site Conceptual Model

The overall site conceptual model was developed and presented in the CAP (ENSR, September 2005). This RDW is focused on the limited excavation proposed in the CAP. Therefore, the hydrogeology is included below. However, discussion of the groundwater remedial action is deferred to a later date.

1.3.1 Geology & Hydrogeology

The site is situated in the northern portion of the Eel River Valley. Subsurface geology in the area includes quarternary-aged non-marine alluvial fan deposits of siltstone, sandstone and mudstone that comprise the overlying marine terrace deposits of Hookton Formation. Underlying the alluvial fan deposits are marine and non-marine overlap deposits of sands, silts and clays that comprise the Rohnerville Formation. Underlying the Rohnerville Formation are undivided sedimentary rocks (conglomerates, sandstones, siltstones, and mudstones) (Department of Mines and Geology Open-File Report 85-01).

Soil types encountered beneath the Site during subsurface investigations conducted to date consist of interbedded silts and clays (i.e., clayey silt, silty clay, silt) from ground surface to approximately 12 feet bgs with pockets of fill in select areas from ground surface to approximately five feet bgs; that is underlain by lenses of sandy silts, silts with sand, silty sand and sands to approximately 20 feet bgs; that is underlain by a layer of silts and clays to a depth of approximately 32 feet bgs; which is subsequently underlain by sand to the maximum depth explored to date of approximately 40 feet bgs. Refer to **Figures 3** through **5** for the geologic cross-sections.

Variations to the above detail are present in the southwest portion of the Site near MW-18/SS-22, where silty sands and silt and clays are present from ground surface to approximately 20 feet bgs and near MW-19 where silt extends from the ground surface to the top of the bottom silt and clay layer at approximately 30 feet bgs.

The geology at the Site as described above and illustrated on **Figures 3** through **5**, indicates there are two confined water bearing zones at the Site, a shallow and a deep zone. The shallow zone is present at the uppermost silty sand/sand/sandy silty lenses located from approximately 12 to 20 feet bgs. The deep zone is present at the bottom sandy layer located from approximately 32 to 40 ft bgs. Both layers are confined by the silt and clay layer overlying each sandy layer. During the groundwater monitoring and sampling event performed on February 8, 2005, depth to shallow groundwater ranged in elevation between 36.41 feet mean sea level (MSL) in MW-7 to 42.79 feet MSL in MW-4 and flowed in a south/southwesterly direction at a gradient of 0.02 feet/foot. Depth to deep groundwater ranged in elevation 24.02 feet MSL in MW-15 to 24.07 feet MSL in MW-16B and flowed in an east by northeast direction at an average gradient of 0.0021 feet/foot.

Historical data and recently obtained data on the Site indicate that the depth to shallow groundwater has ranged from approximately 3 to 14 feet bgs, and shallow groundwater has flowed in a south/southwest direction at an average gradient of 0.02 feet/foot. The depth to deep groundwater has ranged from approximately 20 to 28 feet, and the deep groundwater has flowed in a northeast direction at an average gradient of 0.0019 feet/foot.

Based on previous reports (RESNA 1992), slug testing data, and flex wall permeability testing, an average hydraulic conductivity of 1.3 feet per day or 4.6×10^{-4} centimeters per second (cm/sec) and vadose zone permeability values ranging from 1.5×10^{-7} to 2×10^{-8} cm/sec can be used. From limited groundwater modeling, an anticipated flow of 0.3 gallons per minute, which is consistent with earlier reports of the Site, would be the optimal groundwater extraction rate.

1.3.2 Contaminant Distribution

Soil

Gasoline and diesel impacted soils are located on the northwest portion of the Site in the area of the former AST tanks and associated product lines and in two isolated areas on the southern portion of the Site. The isolated areas are located around MW-20 on the southeast side of the Site, around MW-18 on the southwest side of the Site, and around MW-5 on the northwest side of the Site. None of the isolated areas are located in the immediate vicinity of a former site structure. The area around MW-18 is impacted by diesel, and the areas around MW-20 and MW-5 are both impacted by gasoline and diesel fuels. The area of soil contamination in the northwest corner is approximately 5,100 square feet. The areas of impacted soil in each isolated area are approximately 400 square feet for both MW-18 and MW-20 together, and approximately 60 square feet for MW-5. The extent of the impacted soil areas is depicted on **Figure 6**.

The depth of impacted soils in the northwest corner of the property extends from approximately seven to 20 feet bgs. Soils in the deep water bearing zone are not impacted. The top portion (approximately one to three feet) of impact soil is in the silt and clay layer, but the main impacted soils are located in the silt/sandy silty/sand lenses where the water table, under confining conditions, is located (about 12 to 15 ft bgs). The depth of impacted soils in the isolated areas is approximately 5-15 feet bgs. Silts and clays extend from

ground surface to about 12 feet bgs around MW-18 and from ground surface to approximately 10 feet bgs around MW-20. These estimates are based on soil analytical results from borings completed in 2002 and 2003 (SS series) and borings and monitoring wells completed in 2004; available PID readings from the SS series borings and wells installed in 1991; historical SPH observations; depth to water encountered in boring installation and quarterly groundwater monitoring events; and soil type.

The soil investigation in December 2004 indicated that the borings with the non-detect results (SB-5, SB-6, SB-7) were generally located along the perimeter of the source areas. In the northeast portion of the Site and in the vicinity of MW-3, analysis of the soil boring SB-5 resulted in the detection of TPHd, TPHg and BTEX concentrations at or below the laboratory detection limit.

1.4 Clean-up Criteria

The NCWB-approved soil cleanup criteria are presented in Table 6-2 of the CAP. As stated in **Section 1.0**, the excavation will remove soil with TPH concentrations greater than 1,000 mg/kg. Following removal of these highly impacted, hydrocarbon source areas, natural attenuation will be the remedial approach to meet the soil and groundwater clean-up criteria presented in the CAP.

1.5 Limited Excavation Remedial Action

Four areas of concern are proposed for excavation in order to remove soil containing hydrocarbon compounds at concentrations greater than 1,000 mg/kg. **Figure 6** delineates the areas, designated Alpha, Beta, Gamma, and Delta, where excavations are to be performed. **Figures 6a** through **6d** delineate the vertical extent of the excavations.

The implementation details, construction specifications, and schedule are presented in the following sections. The sampling procedures are described in **Section 2.0**.

1.5.1 Permits and Notifications

ENSR shall secure applicable permits necessary for the project and shall comply with any permit and inspection requirements established by state and/or local regulations.

1.5.2 Underground Utility Clearance

Previous demolition activities at the Site are reported to have removed underground utilities at the former bulk plant. However, Underground Service Alert (USA) will be contacted for utility location marking a minimum of 5 working days prior to mobilizing for the excavation activities. A geophysical survey will be performed after completing the USA markings as an additional precautionary measure. In addition, any subsurface utility clearance/locating required by Unocal/Chevron will also be performed prior to mobilizing for the excavation.

1.5.3 Construction Specifications

The design specifications as described herein will be incorporated into the bid documentation. Specifications for fill material are presented in **Appendix A**. For the work, two of the sites, designated Alpha and Beta on **Figure 6**, will be excavated using a bucket auger rig. For the Alpha excavation, the area surrounding MW-5 had previously been excavated. To minimize the collapse of previously backfilled areas into the new excavation, a bucket auger will be used to remove the remaining contaminated soil. As a result of the property line's proximity to the excavation and in an effort to remove soil with TPH concentrations greater than the excavation criteria, a bucket auger will also be used at the excavation Beta. The other two areas, designated Gamma and Delta, will be excavated using standard equipment.

For the Alpha and Beta excavations, backfill will be one-sack grout slurry. This method of backfill eliminates the need for placing equipment into the excavation and ensures that compaction is met. The Gamma and Delta excavations will be backfilled with clean soils from off-site sources. Compaction of backfill material will be accomplished using standard techniques.

ENSR will coordinate field activities with the excavation subcontractor and the soil sampling team so that samples can be collected prior to the start of backfill operations. Coordination will be critical at the Alpha and Beta excavations. Backfill will need to be placed into each open auger excavation prior to the start of the next auger excavation unless there is at least one auger diameter between consecutive auger excavations. However, no auger excavation will be left open for more than two hours prior to placement of backfill material.

Excess spoil that may drop into the auger excavation prior to placement of backfill material will be removed to the extent practical. Auger excavations will be sampled by ENSR personnel from the perimeter/bottom bucket auger spoils prior to starting placement of backfill material (Section 2.1). Auger excavations will attain the size and depth of the Alpha and Beta excavations shown on **Figures 6, 6c,** and **6d**.

For the Gamma and Delta excavations, the excavation subcontractor will be required to submit an excavation plan detailing methods of excavation and their proposed shoring design to be used. ENSR acceptance of the excavation plan will be completed prior to commencing excavation operations. Shoring design(s) will be prepared by a qualified engineer who shall stamp and sign the design. If in the opinion of the excavation subcontractor it is necessary to dewater an excavation to reach the lateral and vertical extent of the proposed excavation, the proposed procedure and design of the dewatering system will be submitted to ENSR for review and acceptance prior to start of the work.

Excavated soils will be transported off site to a California-licensed landfill approved to accept petroleum contaminated soils. Transportation of soils will be accomplished using end dumps capable of transporting approximately 22 tons of material per load.

1.5.4 Project Schedule

In order to minimize disruption of site access, it is anticipated that the Alpha, Beta, and Gamma excavations will be completed prior to starting excavation of the Delta excavation. It is anticipated that work will begin on or about August 15, 2006. This start date is based on performing the excavation during the time frame when the depth to groundwater is at a maximum. Work is anticipated to be completed within six weeks of the start date. To minimize the local impacts from truck traffic and other activities associated with conducting the excavation, daily field operations will be performed to the extent allowed by local ordinance. The details of the excavations performed and associated soil sampling results will be documented in a Remedial Status Report that will be submitted within 60 days after receipt of all analytical results and soil disposal documentation for the excavated soil.

1.5.5 Excavation Subcontractor Selection

Only subcontractors with demonstrated experience performing similar limited excavations will receive a request for bid. Bids will be compared for completeness and the documented safety performance record of each subcontractor. Selection of the excavation subcontractor will be made after receipt of RDW approval from the agency. ENSR has assumed in the project schedule that the RDW will be approved by the NCWB within 60 days of its submittal.

1.5.6 Potential Delays

The above schedule assumes that the anticipated time frame for the excavation work will not be impacted by conditions that delay or slow down the site activities. Delays to the construction schedule may result if local

ordinance restricts the duration for daily operations, or due to natural causes such as inclement weather or natural disasters.

1.5.7 Security

The Site is currently secured by a chain-link fence that is six feet high. This fence shall remain in place throughout the excavation activities. The access gate located along Main Street will be locked each night at the completion of work. Warning signs concerning the dangers of entering an active construction site will be posted and maintained during this remedial action.

2.0 Post-Excavation Sampling Plan

This section presents the methods and procedures that will be used for determining the residual soil concentrations after the limited removal of contaminated soil.

2.1 Sampling Plan

The following sampling frequencies will be used for the sidewalls of the excavations:

- Alpha – One soil sample from each sidewall of the excavation;
- Beta – One soil sample from each sidewall of the excavation;
- Delta – One soil sample per 25 lineal feet of excavation as measured at the top of the excavation; and
- Gamma – One soil sample from each sidewall of the excavation.

The sample will be collected at the mid-point of the exposed wall face unless a sidewall location(s) visually shows soil staining (soil coloring not homogeneous with surrounding soil). The sidewall sample will be collected from an area of visual soil staining if present. Soil samples from the sidewall will be collected from the perimeter bucket auger spoils and will not be collected below the groundwater table.

The following sampling frequencies will be used for the bottom of the excavations:

- Alpha – One soil sample from the bottom of the excavation (less than 400 square feet);
- Beta – Two soil samples from the bottom of the excavation;
- Delta – One sample for every 400 square feet of exposed soil; and
- Gamma - One soil sample from the bottom of the excavation.

Samples from the floors of the Alpha and Beta excavations will be collected from the bucket auger spoils collected from the bottom of the auger excavation. Samples from the floor of the excavation will be collected and analyzed even if the excavation floor is below the water table.

Soil samples will be collected in brass or stainless steel cylinders having approximate dimensions of two-inch diameter by six-inches in length. The cylinders will be pushed into the surface of the sidewall or floor, or into the spoil in the bucket/auger, so that the cylinder is filled with soil. Both ends of the cylinder will be sealed, labeled with a unique sample identification number, and stored on ice pending transport to the laboratory for analysis. The unique sample identification number will be entered onto a chain-of-custody form along with the requested analyses. The chain-of-custody form(s) will be placed in a water-proof bag and placed inside the storage chest with the samples pending transport to the laboratory.

Soil samples will be analyzed for BTEX by EPA Method 8021B, TPHg by EPA Method 8015M, and TPHd by EPA Method 8015M with silica gel treatment by EPA Method 3630.

3.0 Health and Safety Plan

A site-specific Health and Safety Plan (HASP) will be developed and provided at a later date. The HASP will provide an assessment of hazards and evaluations of the risks associated with conducting the fieldwork at the Site, and will be compliant with OSHA requirements. Available site information shall be examined to select and implement appropriate warnings and safeguards for field personnel and the public.

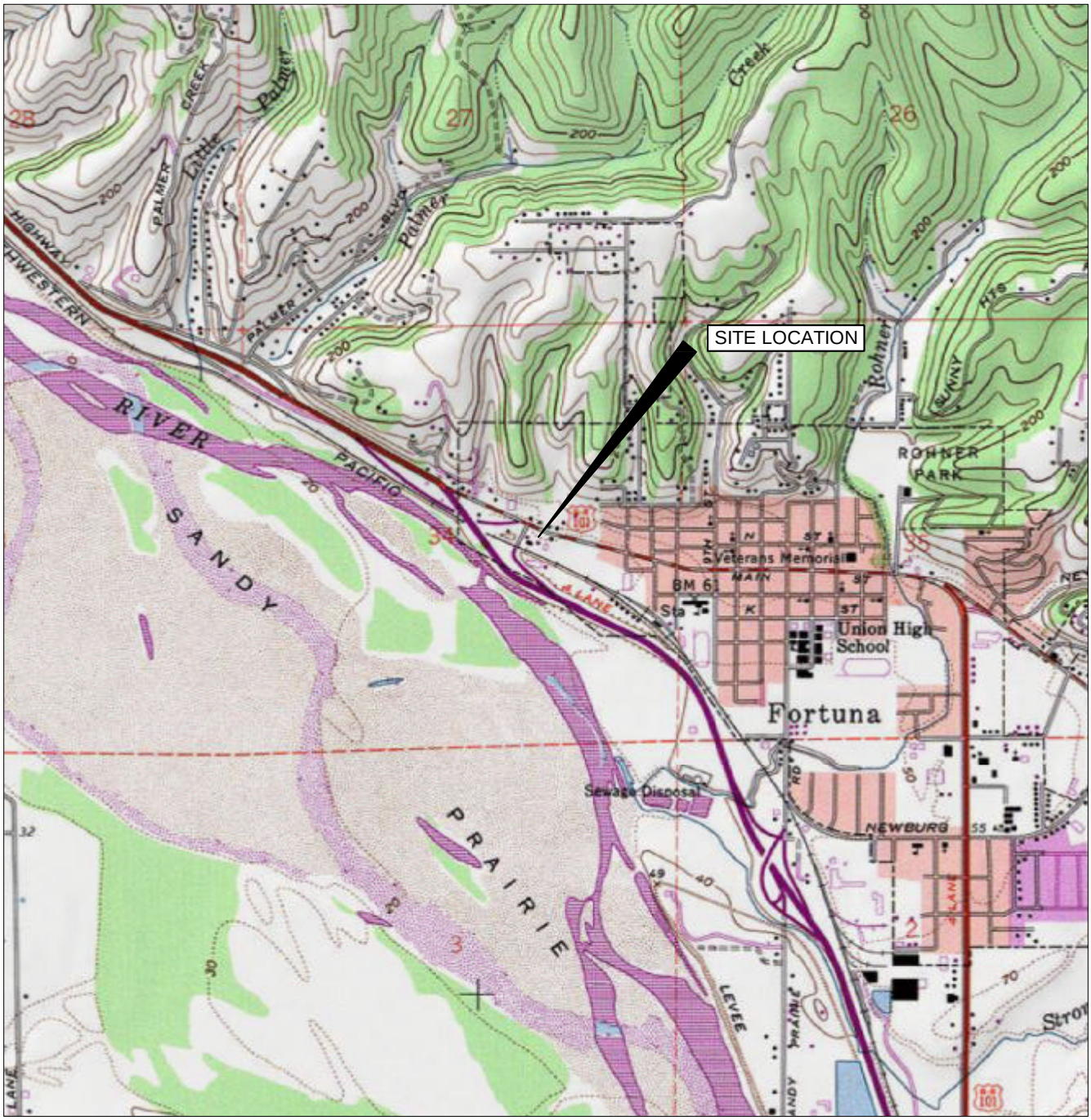
Every field personal will be briefed on the project site conditions and safety requirements prior to initiating the excavation activities. Daily tailgate meetings will be held to review the day's field activities and associated health and safety practices. The excavation subcontractor will be required to submit a HASP that, at a minimum, meets the health and safety criteria set forth by ENSR's HASP.

Figures

Appendix A

Class II AB Specification

Figures



Map created with TOPO - 2003 National Geographic

MAP LOCATION

SOURCE: BASE MAP FROM USGS FORTUNA, CA
7.5 MINUTE TOPOGRAPHIC 1972

N

0 2000

Approximate Scale
in Feet

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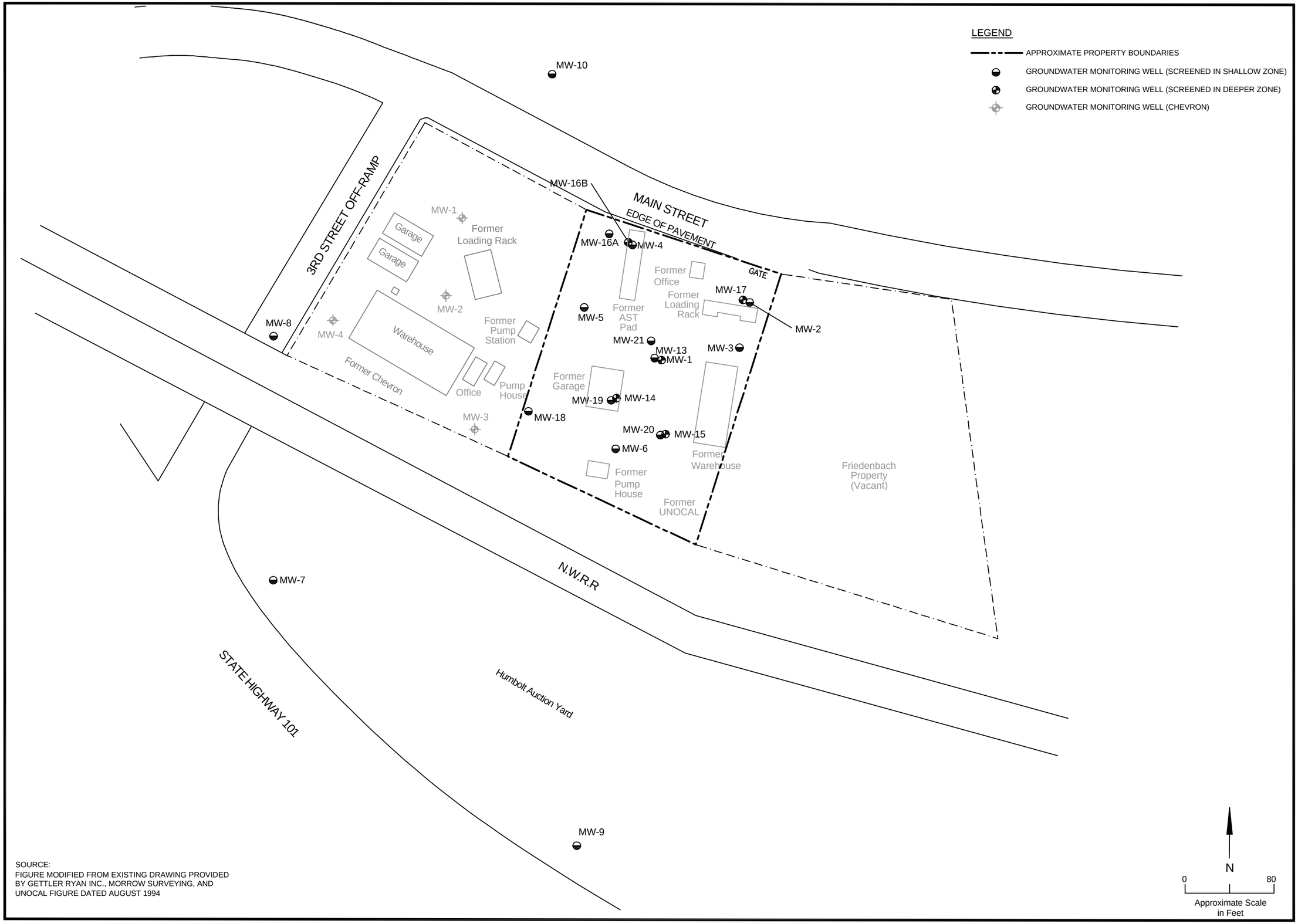
SITE LOCATION MAP

FORMER UNOCAL BULK PLANT 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

FIGURE NUMBER:
1

DRAWN BY:	DATE:	PROJECT NUMBER:	SHEET NUMBER:
MD	1/13/06 PR	06940-407	1



SOURCE:
FIGURE MODIFIED FROM EXISTING DRAWING PROVIDED BY GETTLER RYAN INC., MORROW SURVEYING, AND UNOCAL FIGURE DATED AUGUST 1994

REVISIONS			
NO.:	DESCRIPTION:	DATE:	BY:

DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
X	K.P.B.	S.W.	X

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SITE MAP

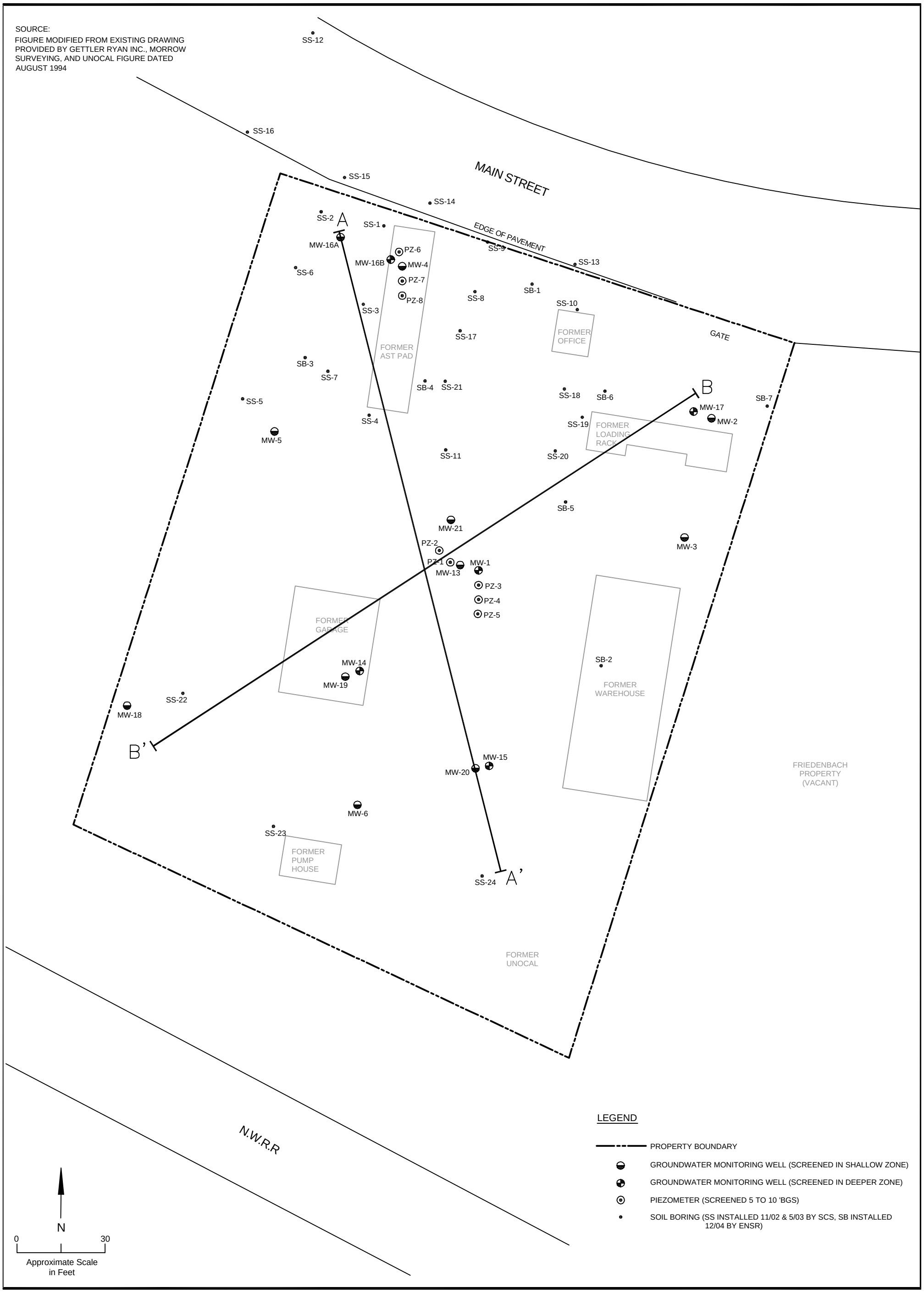
FORMER UNOCAL BULK PLANT 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE:	DATE:	PROJECT NUMBER:
1"=80'	1/06 PR	06940-407-100

FIGURE NUMBER:
2

SHEET NUMBER:
1

SOURCE:
FIGURE MODIFIED FROM EXISTING DRAWING PROVIDED BY GETTLER RYAN INC., MORROW SURVEYING, AND UNOCAL FIGURE DATED AUGUST 1994



SHEET NUMBER: 1

FIGURE NUMBER: 3

GEOLOGIC CROSS-SECTION TRANSECT

FORMER UNOCAL BULK PLANT 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE:	DATE:	PROJECT NUMBER:
1" = 30'	1/13/06 PR	06940-407

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DESIGNED BY:	REVISIONS			
X	NO.:	DESCRIPTION:	DATE:	BY:
DRAWN BY:				
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CHECKED BY:				
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APPROVED BY:				
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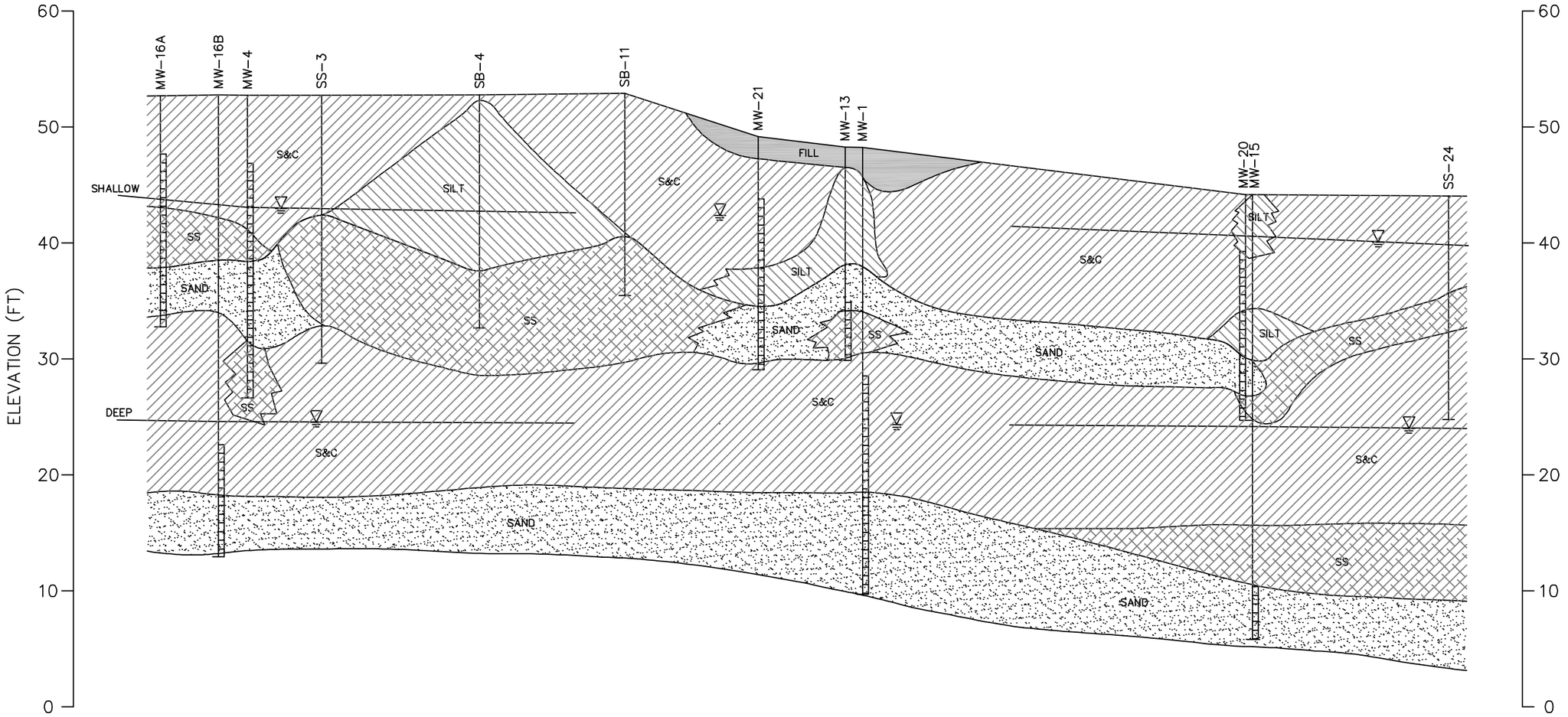

LEGEND

- FILL
- SILT
- SILTS & CLAYS (S&C)
- SILT WITH SAND/SANDY SILT (SS)
- SAND

SS – BORING COMPLETED BY SCS ENGINEERS 11/02 & 5/03

SB – BORING COMPLETED BY ENSR 12/04

MW – WELL INSTALLATION COMPLETED BY ENSR 12/04

10
0 20
SCALE IN FEET

REVISIONS			
NO.:	DESCRIPTION:	DATE:	BY:

DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
X	K.P.B.	S.W.	X

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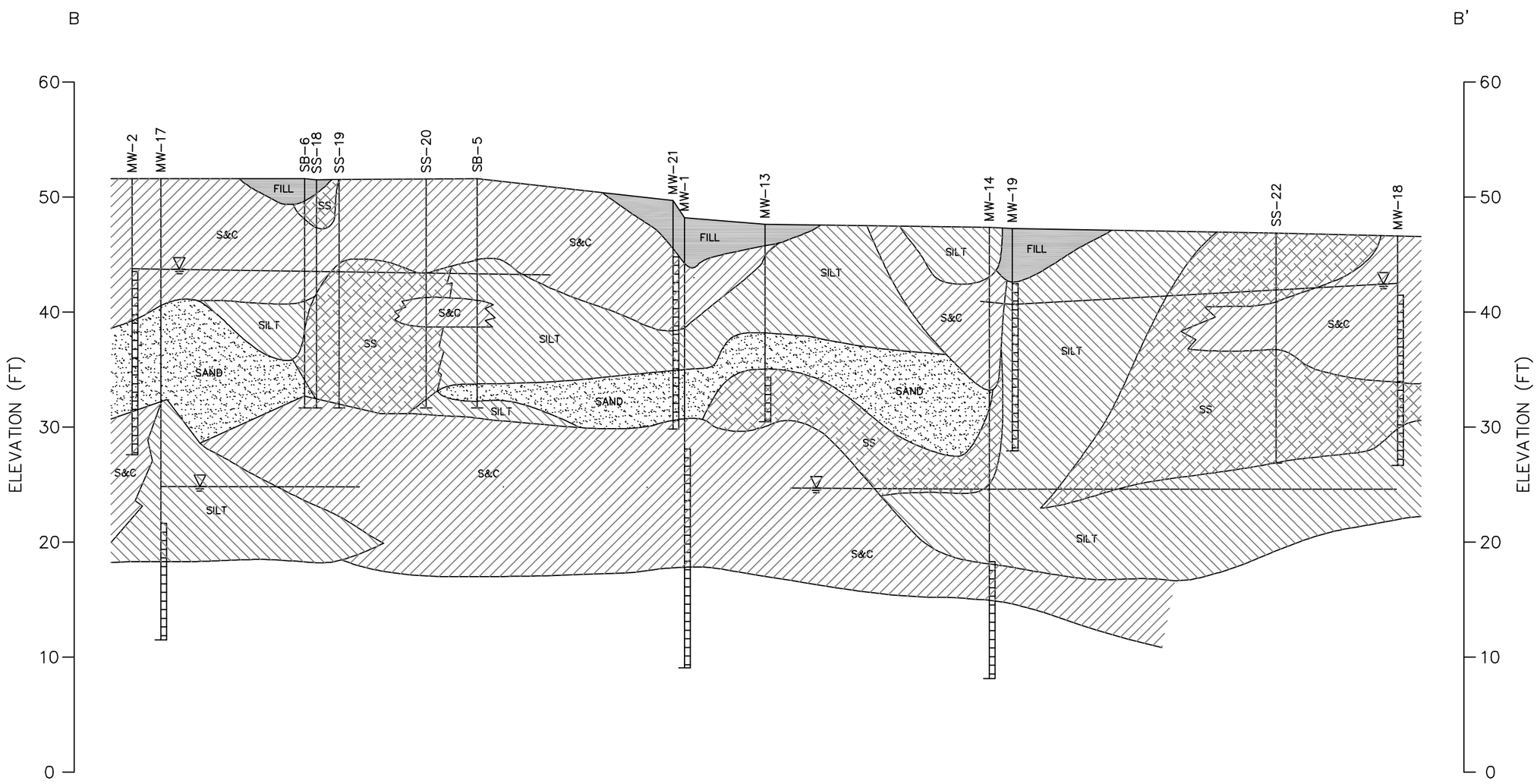
GEOLOGIC CROSS-SECTION A-A'

FORMER UNOCAL BULK PLANT 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE:	DATE:	PROJECT NUMBER:
AS SHOWN	1/06 PR	06940-407

FIGURE NUMBER: 4

SHEET NUMBER: 1



LEGEND

- FILL
- SILT
- SILTS & CLAYS (S&C)
- SILT WITH SAND/SANDY SILT (SS)
- SAND

SS – BORING COMPLETED BY SCS ENGINEERS 11/02 & 5/03

SB – BORING COMPLETED BY ENSR 12/04

MW – WELL INSTALLATION COMPLETED BY ENSR 12/04

10
0 20
SCALE IN FEET

REVISIONS			
NO.:	DESCRIPTION:	DATE:	BY:

DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
X	K.P.B.	S.W.	X

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GEOLOGIC CROSS-SECTION B-B'

FORMER UNOCAL BULK PLANT 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE:	DATE:	PROJECT NUMBER:
AS SHOWN	1/06 PR	06940-407

FIGURE NUMBER:
5

SHEET NUMBER:
1

SOURCE:
FIGURE MODIFIED FROM EXISTING DRAWING PROVIDED BY GETTLER RYAN INC., MORROW SURVEYING, AND UNOCAL FIGURE DATED AUGUST 1994

SS-12
SS-16
SS-15
MAIN STREET
SS-14
SS-2
SS-1
EDGE OF PAVEMENT
MW-16A
PZ-6
SS-9
SS-13
MW-16B
MW-4
SS-6
PZ-7
SB-1
SS-3
PZ-8
SS-8
SS-10
FORMER OFFICE
SS-17
GATE
FORMER UST PAD
DELTA
SB-3
SS-7
SB-4
SS-21
SS-18
SB-6
SB-7
SS-5
MW-17
MW-2
SS-4
SS-19
FORMER LOADING RACK
MW-5
SS-11
ALPHA
SS-20
SB-5
MW-21
MW-3
PZ-2
PZ-1
MW-13
MW-1
PZ-3
PZ-4
PZ-5
FORMER GARAGE
SB-2
MW-14
MW-19
FORMER WAREHOUSE
SS-22
MW-18
BETA
MW-15
MW-20
GAMMA
FRIEDENBACH PROPERTY (VACANT)
MW-6
SS-23
FORMER PUMP HOUSE
SS-24
FORMER UNOCAL
N.W.R.R

LEGEND

- AREA OF IMPACTED SOIL
- AREA OF PREVIOUS EXCAVATIONS
- PROPERTY BOUNDARY
- GROUNDWATER MONITORING WELL (SCREENED IN SHALLOW ZONE)
- GROUNDWATER MONITORING WELL (SCREENED IN DEEPER ZONE)
- PIEZOMETER (SCREENED 5 TO 10 'BGS)
- SOIL BORING (SS INSTALLED 11/02 & 5/03 BY SCS, SB INSTALLED 12/04 BY ENSR)

N
0 30
Approximate Scale in Feet

SHEET NUMBER: 1
FIGURE NUMBER: 6

AREAS OF IMPACTED SOILS

FORMER UNOCAL BULK PLANT 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE:	DATE:	PROJECT NUMBER:
1" = 30'	1/17/06 PR	06940-407

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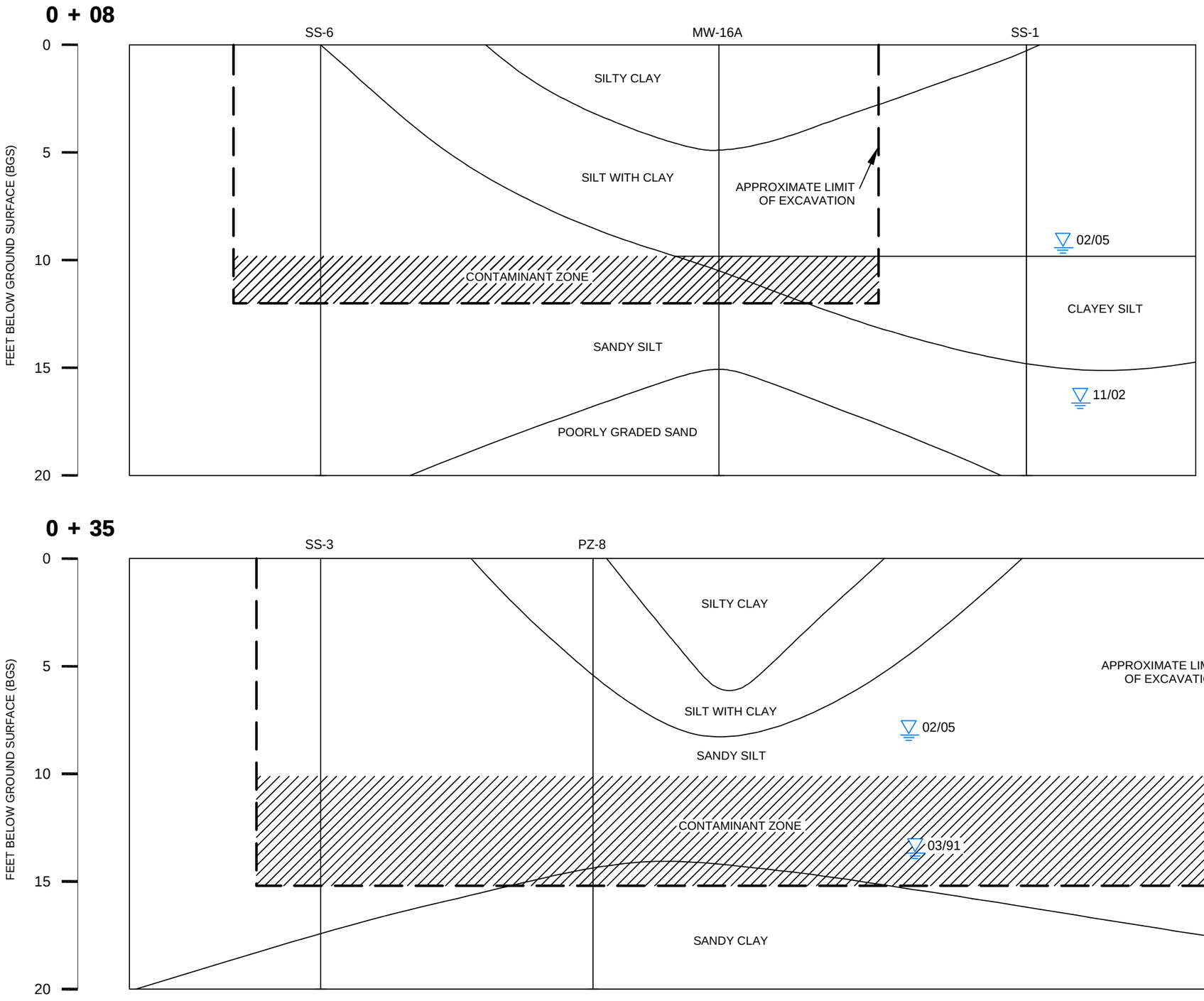
DESIGNED BY:	REVISIONS			
X	NO.:	DESCRIPTION:	DATE:	BY:
DRAWN BY:				
X				
CHECKED BY:				
X				
APPROVED BY:				
X				



SCALE IN FEET
NO VERTICAL EXAGGERATION

REVISIONS	NO.:	DESCRIPTION:	DATE:	BY:

DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
X	X	X	X

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CROSS SECTIONS

FORMER UNOCAL BULK PLANT 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

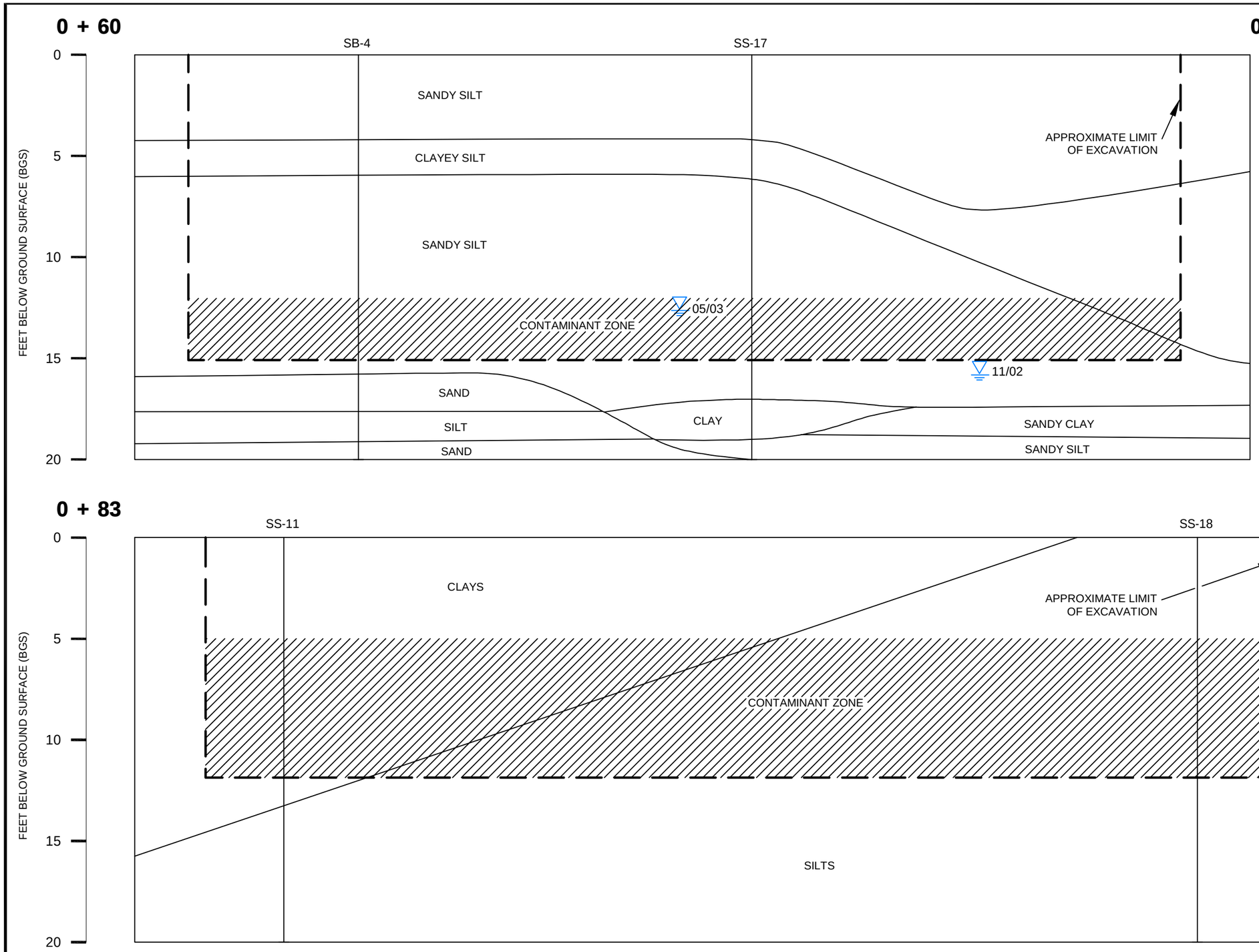
SCALE:	DATE:	PROJECT NUMBER:
1" = 5'	2/1/06 PR	06940-407

FIGURE NUMBER:

6A

SHEET NUMBER:

1



5
0
0
5
SCALE IN FEET
NO VERTICAL
EXAGGERATION

REVISIONS	NO.:	DESCRIPTION:	DATE:	BY:

DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
X	X	X	X

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CROSS SECTIONS

FORMER UNOCAL BULK PLANT 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE:	DATE:	PROJECT NUMBER:
1" = 5'	2/1/06 PR	06940-407

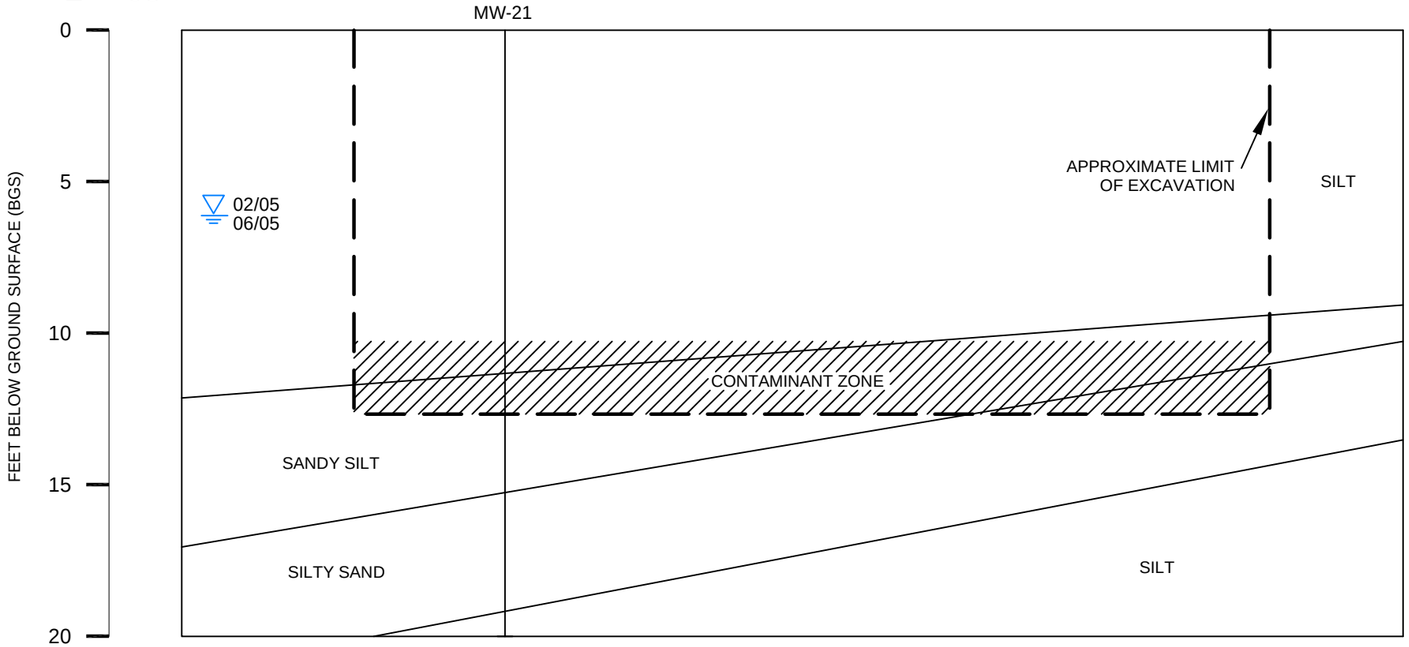
FIGURE NUMBER:

6B

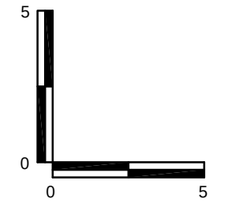
SHEET NUMBER:

1

1 + 08



1 + 08



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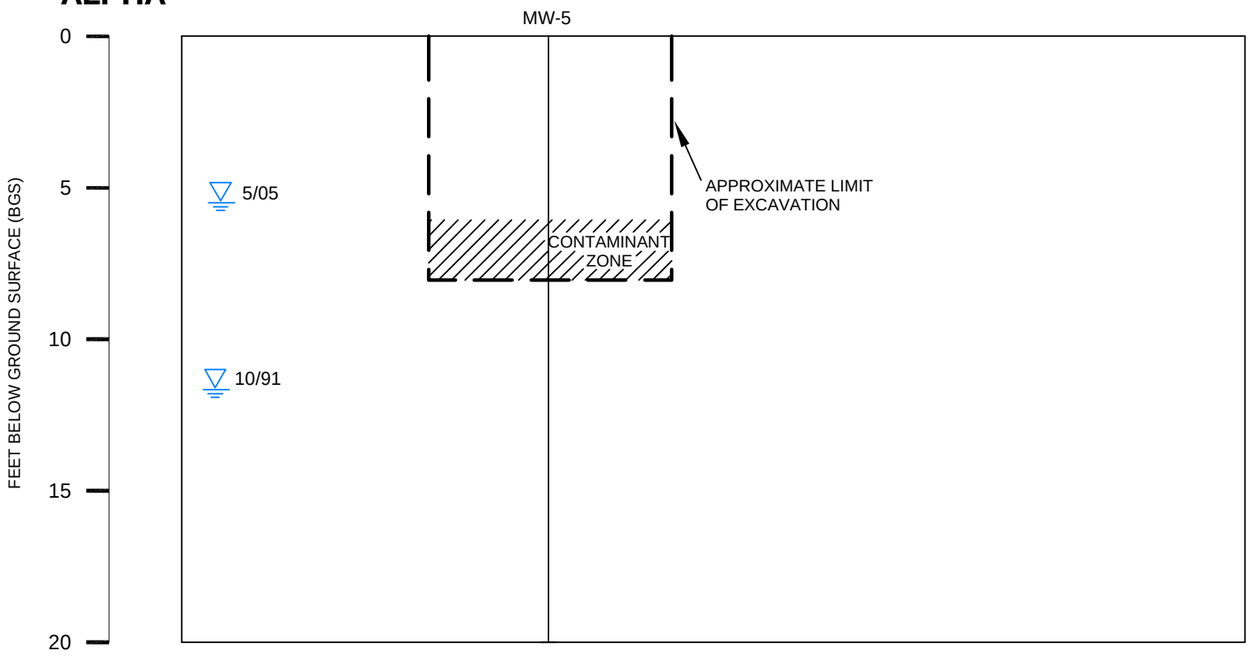

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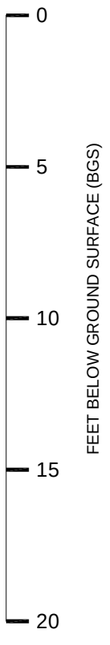

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DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
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CROSS SECTIONS

FORMER UNOCAL BULK PLANT 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE:	DATE:	PROJECT NUMBER:
1" = 5'	2/1/06 PR	06940-407

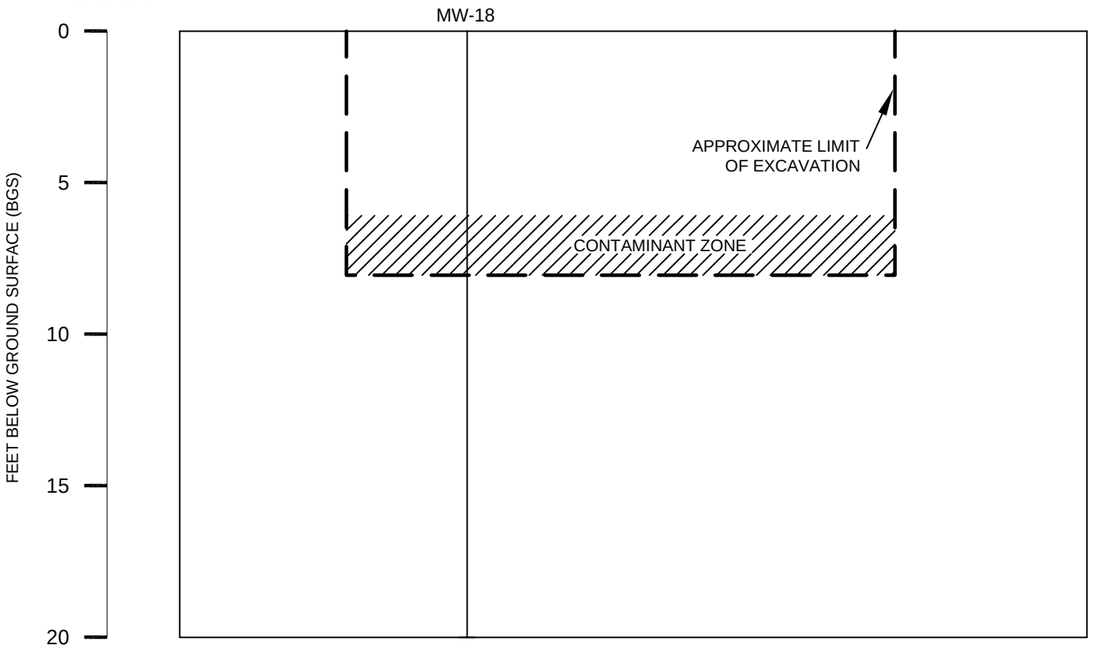
FIGURE NUMBER:

6C

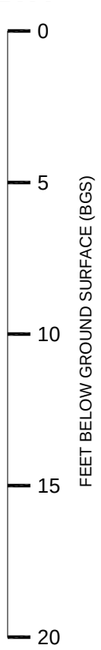
SHEET NUMBER:

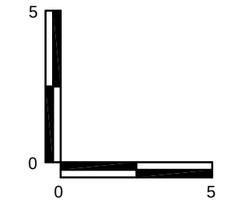
1

BETA

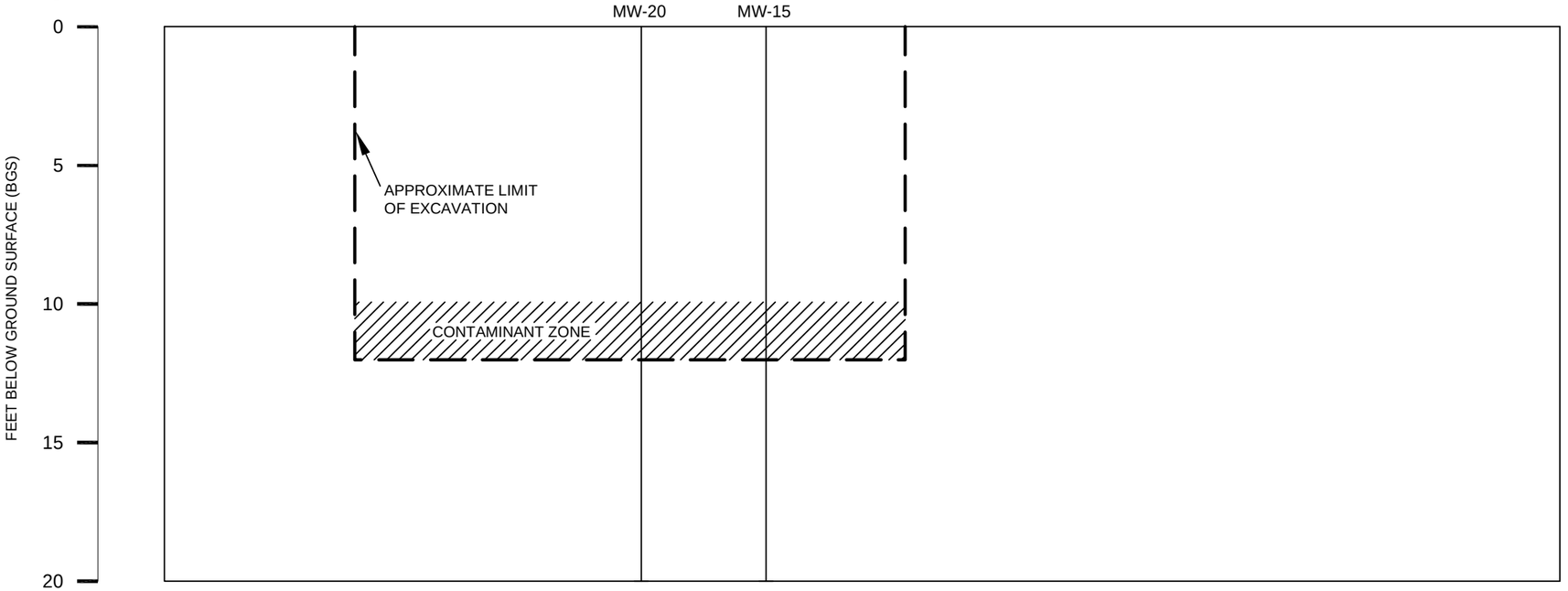


BETA

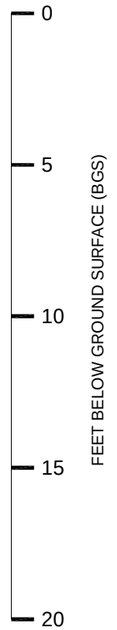




GAMMA



GAMMA



REVISIONS			
NO.:	DESCRIPTION:	DATE:	BY:

DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
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CROSS SECTIONS

FORMER UNOCAL BULK PLANT 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE:	DATE:	PROJECT NUMBER:
1" = 5'	2/1/06 PR	06940-407

FIGURE NUMBER:

6D

SHEET NUMBER:

1

Appendix A

Class II AB Specification

SECTION 26: AGGREGATE BASES

26-1.01 DESCRIPTION

• This work shall consist of furnishing, spreading and compacting aggregate bases as specified in these specifications and the special provisions.

• Aggregate bases are designated as Class 2 and Class 3. The class of aggregate base will be shown on the plans or specified in the special provisions.

26-1.02 MATERIALS

• Aggregate for the various classes of aggregate base at the time it is deposited on the roadbed shall conform to the following requirements:

26-1.02A Class 2 Aggregate Base

• Aggregate for Class 2 aggregate base shall be free from organic matter and other deleterious substances, and shall be of such nature that it can be compacted readily under watering and rolling to form a firm, stable base. Aggregate may include material processed from reclaimed asphalt concrete, portland cement concrete, lean concrete base, cement treated base or a combination of any of these materials. The amount of reclaimed material shall not exceed 50 percent of the total volume of the aggregate used.

• Aggregate shall conform to the grading and quality requirements shown in the following tables. At the option of the Contractor, the grading for either the 37.5-mm {$1\frac{1}{2}$-inch} maximum or 19-mm {$\frac{3}{4}$-inch} maximum shall be used, except that once a grading is selected the grading shall not be changed without the Engineer's written approval.

AGGREGATE GRADING REQUIREMENTS

	Percentage Passing			
	37.5-mm {$1\frac{1}{2}$"} Maximum		19-mm {$\frac{3}{4}$"} Maximum	
Sieve Sizes	Operating Range	Contract Compliance	Operating Range	Contract Compliance
50-mm {2"}	100	100	—	—
37.5-mm {$1\frac{1}{2}$"}	90-100	87-100	—	—
25-mm {1"}	—	—	100	100
19-mm {$\frac{3}{4}$"}	50-85	45-90	90-100	87-100
4.75-mm {No. 4}	25-45	20-50	35-60	30-65
600-µm {No. 30}	10-25	6-29	10-30	5-35
75-µm {No. 200}	2-9	0-12	2-9	0-12

QUALITY REQUIREMENTS

Test	Operating Range	Contract Compliance
Resistance (R-value)	—	78 Min.
Sand Equivalent	25 Min.	22 Min.
Durability Index	—	35 Min.

• The aggregate shall not be treated with lime, cement or other chemical material before the Durability Index test is performed. Untreated reclaimed asphalt concrete and portland cement concrete will not be considered to be treated with lime, cement or other chemical material for purposes of performing the Durability Index test.

• If the results of either or both the aggregate grading and Sand Equivalent tests do not meet the requirements specified for "Operating Range" but meet the "Contract Compliance" requirements, placement of the aggregate base may be continued for the remainder of that day. However, another day's work may not be started until tests, or other information, indicate to the satisfaction of the Engineer that the next material to be used in the work will comply with the requirements specified for "Operating Range."

• If the results of either or both the aggregate grading and Sand Equivalent tests do not meet the requirements specified for "Contract Compliance," the aggregate base which is represented by these tests shall be removed. However, if requested by the Contractor and approved by the Engineer, the aggregate base may remain in place, and the Contractor shall pay to the State $3.00 per cubic meter {$2.25 per cubic yard} for the aggregate base represented by the tests and left in place. The Department may deduct this amount from any moneys due, or that may become due, the Contractor under the contract. If both the aggregate grading and Sand Equivalent do not conform to the "Contract Compliance" requirements, only one adjustment shall apply.

• No single aggregate grading or Sand Equivalent test shall represent more than 400 m^3 {500 cubic yards} or one day's production, whichever is smaller.

• When aggregate base is to be measured by the tonne {ton}, the mass will be converted to volume for the purpose of the above paragraphs. Factors for converting tonnes {tons} to cubic meters {cubic yards} will be determined by the Engineer.

26-1.02B Class 3 Aggregate Base

• Aggregate for Class 3 aggregate base shall conform to the requirements set forth in the special provisions. Aggregate may include material processed from reclaimed asphalt concrete, portland cement concrete, lean concrete base, cement treated base or a combination of any of these materials. The amount of reclaimed material shall not exceed 50 percent of the total volume of the aggregate used.

• The grading of aggregate for Class 3 aggregate base shall, at the option of the Contractor, conform either to the grading specified in the special provisions or to either the 37.5-mm {$1\frac{1}{2}$-inch} maximum or the 19-mm {$\frac{3}{4}$-inch} maximum grading for Class 2 aggregate base specified in Section 26-1.02A, "Class 2 Aggregate Base." Once a grading is selected, the grading shall not be changed without written approval of the Engineer.

26-1.03 SUBGRADE

• The subgrade to receive aggregate base, immediately prior to spreading shall conform to the compaction and elevation tolerance specified for the material involved, and shall be free of loose or extraneous material.

• When aggregate base is paid for by the cubic meter {cubic yard}, areas of the finished surface of aggregate subbase which are lower than the grade established by the Engineer shall be filled with aggregate base. Volumes of aggregate base so placed will not be included in the volume calculated for payment.

• When aggregate subbase is not specified and aggregate base is paid for by the cubic meter {cubic yard}, areas of the grading plane which are lower than the grade established by the Engineer may be filled with aggregate base. Volumes of aggregate base so placed will not be included in the volume calculated for payment as stated above. If basement material consists of imported borrow, aggregate base

- If the results of either or both the aggregate grading and Sand Equivalent tests do not meet the requirements specified for "Operating Range" but meet the "Contract Compliance" requirements, placement of the aggregate base may be continued for the remainder of that day. However, another day's work may not be started until tests, or other information, indicate to the satisfaction of the Engineer that the next material to be used in the work will comply with the requirements specified for "Operating Range."
- If the results of either or both the aggregate grading and Sand Equivalent tests do not meet the requirements specified for "Contract Compliance," the aggregate base which is represented by these tests shall be removed. However, if requested by the Contractor and approved by the Engineer, the aggregate base may remain in place, and the Contractor shall pay to the State $3.00 per cubic meter {$2.25 per cubic yard} for the aggregate base represented by the tests and left in place. The Department may deduct this amount from any moneys due, or that may become due, the Contractor under the contract. If both the aggregate grading and Sand Equivalent do not conform to the "Contract Compliance" requirements, only one adjustment shall apply.
- No single aggregate grading or Sand Equivalent test shall represent more than 400 m^3 {500 cubic yards} or one day's production, whichever is smaller.
- When aggregate base is to be measured by the tonne {ton}, the mass will be converted to volume for the purpose of the above paragraphs. Factors for converting tonnes {tons} to cubic meters {cubic yards} will be determined by the Engineer.

26-1.02B Class 3 Aggregate Base

- Aggregate for Class 3 aggregate base shall conform to the requirements set forth in the special provisions. Aggregate may include material processed from reclaimed asphalt concrete, portland cement concrete, lean concrete base, cement treated base or a combination of any of these materials. The amount of reclaimed material shall not exceed 50 percent of the total volume of the aggregate used.
- The grading of aggregate for Class 3 aggregate base shall, at the option of the Contractor, conform either to the grading specified in the special provisions or to either the 37.5-mm {$1\frac{1}{2}$-inch} maximum or the 19-mm {$\frac{3}{4}$-inch} maximum grading for Class 2 aggregate base specified in Section 26-1.02A, "Class 2 Aggregate Base." Once a grading is selected, the grading shall not be changed without written approval of the Engineer.

26-1.03 SUBGRADE

- The subgrade to receive aggregate base, immediately prior to spreading shall conform to the compaction and elevation tolerance specified for the material involved, and shall be free of loose or extraneous material.
- When aggregate base is paid for by the cubic meter {cubic yard}, areas of the finished surface of aggregate subbase which are lower than the grade established by the Engineer shall be filled with aggregate base. Volumes of aggregate base so placed will not be included in the volume calculated for payment.
- When aggregate subbase is not specified and aggregate base is paid for by the cubic meter {cubic yard}, areas of the grading plane which are lower than the grade established by the Engineer may be filled with aggregate base. Volumes of aggregate base so placed will not be included in the volume calculated for payment as stated above. If basement material consists of imported borrow, aggregate base

placed below the grade established by the Engineer will not be measured or paid for as imported borrow.

26-1.035 ADDING WATER

• At the time aggregate base is spread it shall have a moisture content sufficient to obtain the required compaction. The moisture shall be uniformly distributed throughout the material.

26-1.04 SPREADING

• Aggregate bases shall be delivered to the roadbed as uniform mixtures. The mixture shall be deposited and spread to the required compacted thickness within the tolerances specified in Section 26-1.05, "Compacting," by means which will maintain the uniformity of the mixture. Each layer shall be free from pockets of coarse or fine material.

• Where the required thickness is 150 mm {0.50-foot} or less, the base material may be spread and compacted in one layer. Where the required thickness is more than 150 mm {0.50-foot}, the base material shall be spread and compacted in 2 or more layers of approximately equal thickness, and the maximum compacted thickness of any one layer shall not exceed 150 mm {0.50-foot}.

• Aggregate bases, placed on road approaches and connections, street intersection areas, median strip areas, shoulder areas, and at locations which are inaccessible to the spreading equipment, may be spread in one or more layers by any means to obtain the specified results.

• When the subgrade for aggregate base consists of cohesionless sand, and written permission is granted by the Engineer, a portion of the aggregate base may be dumped in piles upon the subgrade and spread ahead from the dumped material in sufficient quantity to stabilize the subgrade. Segregation of aggregate shall be avoided and each layer shall be free from pockets of coarse or fine material.

26-1.05 COMPACTING

• Aggregate bases, after compaction, shall be watered in conformance with the provisions in Section 17, "Watering."

• The relative compaction of each layer of compacted base material shall be not less than 95 percent.

• The surface of the finished aggregate base at any point shall not vary more than 15 mm {0.05-foot} above or below the grade established by the Engineer.

• When aggregate base is paid for by the cubic meter {cubic yard}, and at locations where the planned thickness of aggregate base, less allowable tolerance, is not obtained, the Contractor shall take such corrective measures as are necessary to obtain that thickness. If requested by the Contractor and permitted by the Engineer, a deduction will be made from contract payment for aggregate base in lieu of correcting the deficient thickness. The deduction will be computed as the product of (a) the deficient thickness less allowable tolerance; (b) the planned width; and (c) the longitudinal distance between locations showing specified thickness, all as determined by the Engineer, multiplied by a fixed price of $22.25 per cubic meter {$17.00 per cubic yard}, or the contract bid price, whichever is higher.

• Base which does not conform to the above requirements shall be reshaped or reworked, watered and thoroughly recompacted to conform to the specified requirements.

26-1.06 MEASUREMENT

- Quantities of aggregate base to be paid for by the tonne {ton} will be measured in conformance with the provisions in Section 9-1.01, "Measurement of Quantities," and in this Section 26-1.06.
- The mass of material to be paid for will be determined by deducting from the mass of material delivered to the work, the mass of water in the material, at the time of weighing, as determined by California Test 226, in excess of one percentage point more than the optimum moisture content as determined by California Test 216. The mass of water deducted in conformance with the provisions in this Section 26-1.06 will not be paid for.
- Quantities of aggregate base to be paid for by the cubic meter {cubic yard} will be calculated on the basis of the dimensions shown on the plans adjusted by the amount of any change ordered by the Engineer. No allowance will be made for aggregate base placed outside those dimensions unless otherwise ordered by the Engineer.

26-1.07 PAYMENT

- Quantities of aggregate base will be paid for at the contract price per tonne {ton} or cubic meter {cubic yard}, whichever unit is designated in the contract item, for the class or classes involved.
- The above prices and payments shall include full compensation for furnishing all labor, materials (including water in the material at the time of weighing as provided in Section 26-1.06, "Measurement"), tools, equipment, and incidentals, and for doing all the work involved in constructing aggregate base, complete in place, as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer.